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Night Operations Urban Trainer (NightOUT): SBIR Phase I

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Realistic urban training sites have been built to further the Army's goal to "train as we fight". However, these sites are expensive to build. High demand for time at these sites limits availability to troops. The proposed computer-based training system, the Night Operations Urban Trainer (NightOUT), will provide interactive scenario-based skill practice that should transfer to physical training sites and real world operations. NightOUT will address aided (thermal, image intensification) and unaided night vision issues that impact command and control in urban environments. The training system will adapt the scenarios, guidance and feedback to the individual's skills and needs. This report summarizes the results of Phase I and describes the proposed design for a Phase II development effort.

15. SUBJECT TERMS night operations, urban settings, MOUT, training system, night vision devices, scenarios, image intensification, thermal, unaided night vision, adaptive training, computer-based training

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NIGHT OPERATIONS URBAN TRAINER (NIGHTOUT): SBIR PHASE I

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Identification and Significance of the Problem

"The Army is transforming into a more strategically responsive full-spectrum force that will be dominant at every point on the spectrum of operations. ... The Objective Force will provide ... an increased range of options for regional engagement, crisis response, and sustained land force operations." (AUSA Transformation Panel, 2000). Increasingly our troops are faced with missions that take place at night and in urban settings. The ability to effectively operate in these conditions will be a critical determiner of successful mission outcomes and meeting the goals of the Army Transformation and The Objective Force.

While better equipment for night operations helps to improve a soldier's ability to 'see' at night, the equipment itself offers training and performance issues. Equipment for night operations is continually improving. Successive generations of devices are being fielded such as, night vision goggles (NVG), night sights, thermal sights, aiming lights, and laser pointers. Many units have various combinations of equipment with different models. In particular, confusion arises when technology evolves separately for each piece of equipment that is used together, such as aiming lights along with NVGs (Dyer & Ford, 1998).

Proper and effective use of night devices is not the only task performance issue for night operations. Research by the Dismounted Battlespace Battle Lab (DBBL) and the Army Research Institute (ARI) at Fort Benning indicate difficulties with a number of tasks. Coordination with adjacent units, linkup with a moving unit, breaching an obstacle, searching an area, and maintaining noise and light discipline are only a few of problems noted (Dyer & Ford, 1998).

The number of operations conducted in urban environments has been increasing over the last ten years. Historically, military operations in urban terrain (MOUT) have demonstrated high numbers of casualties and large expenditures of resources. MOUT presents a complex web of social and humanitarian issues. Commanders must now also contend with issues such as collateral damage avoidance, safety and proper handling of non-combatants, refugee migrations, protection of humanitarian assistance operations, collapse of local governmental institutions and social services (Command and General Staff College, n.d.).

Realistic urban training sites have been built to further the Army's goal to "train as we fight". The Joint Readiness Training Center MOUT complex has an airfield, a village with 27

multi-story buildings, and a precision engagement area for live-fire exercises (Webster, 1996). A recently completed MOUT site at Ft. Knox is a 26-acre facility with a bridge, underground tunnel system, and 22 buildings with furnishings (Eilerman, 1999). These types of sites provide the best opportunity for realistic training.

However, these training sites are expensive to build and operate. The Ft. Knox site cost $13.2 million to construct. No figures were given for operational costs, especially including all the special effects (e.g., explosions, collapsing bridge, sound effects) that were developed with the assistance from Universal Studios, MGM and Disney (Eilerman, 1999). The number of these urban training sites is limited and thus troops and commanders may have few opportunities to take advantage of training at these locations.

Performance at these training sites and in actual operations can be improved with advance training. Some aspects of this training and cognitive skill practice can be realized via a computer. A few computer-based training (CBT) programs have been developed to address night training, but these have focused on perceptual skills (e.g., vehicle and aircraft identification). However, advances in computing technology now lend themselves to training on more complex, cognitive issues, such as the impact of night operations on command and control tasks. Adaptive training systems can present interactive scenarios for skill practice with guidance and feedback tailored to the individual.

One of the key variables to success in the Objective Force Warrior program is to find new training methods for soldiers to attain high cognitive performance. High cognitive performance includes the effective use of information and technologies, and split second decision –making. Training for high cognitive performance must include scenario-based applications that are tailored to the individual's skills and needs.

This proposed project will leverage advanced technologies to build a computer-based training system for night operations in urban settings. We will call the training system, Night Urban Operations Trainer (NightOUT). NightOUT will provide interactive scenarios that will address aided (thermal, image intensification) and unaided night vision issues that impact command and control in urban environments. The training system will adapt the scenarios, guidance and feedback to the individual's skills and needs.

Results of Phase I

Front-end Analysis – Method and Sources

The first task was to conduct a front-end analysis of the unique training requirements associated with effectively utilizing night equipment in urban settings. We needed to determine the scope of the night equipment and the range of missions and tasks that might be considered for a Phase II implementation. Deficiencies in the current training and doctrine literature and training support materials also needed to be identified. The selection of the tasks for Phase II was based on what would best demonstrate the capabilities of the training system, what could be completed within the scope of the Phase II project, and what issues are the most critical. The front-end analysis conducted in Phase I was based on the four factors discussed below.

In-house expertise. The first author of the report shaped the front-end analysis. Mr. Marsh was a career Special Forces soldier with over 20 years of experience in unaided and aided night visual techniques with numerous practical applications using and training small unit tactics and techniques. He was assigned as team sniper, engineer, intelligence sergeant, team sergeant and warrant officer on an 'A' team. Mr. Marsh has been trained in and conducted operations in both night and night urban close quarters combat scenarios.

Review of materials. We identified and reviewed a wide variety of materials, including studies and research reports. But the vast majority of the materials focused on basic night vision fundamentals and identification tasks. Some materials addressed broader issues such as conducting night operations or operations in urban terrain. Yet, we were particularly searching for any existing training materials in use for night urban operations tasks.

Night urban operations material was not readily available. However, we did obtain a program of instruction (POI) on driver night vision training from Fort Eustis and a POI on Special Forces Advance Urban Combat (SFAUC) from Fort Bragg. These materials proved very useful in the front-end analysis. They provided us with two essential elements. One, they had an up-to-date format of the current training approach and methodology used by the Army. Two, they contained a portion of the material to be covered in the adaptive pre-test that will be used to judge basic knowledge in the topic domain.

SME interviews. Several interviews were conducted at Fort Bragg, North Carolina. The primary objectives of the interviews were to scrub the initial domain draft and task list to ensure it included all relevant areas, and to gain some insights into which areas were most critical (operational need, lack of training, etc.).

Interviewees consisted primarily of Active and Retired Special Forces members, currently working in the Special Warfare Center and School (SWCS) and members of the 3rd Special Forces Group. One interviewee had the position of Assistant S3 of the 1st Special Warfare Training Battalion responsible for all entry-level training of Special Forces soldiers and one interviewee was the training developer for the 18B and 18C Special Forces Qualification Course (SFQC). All of the interviewees had extensive experience with night vision equipment and conducting night operations in urban terrain. Their insights and knowledge were drawn from a wide variety of night training exercises and operations (e.g., Vietnam, SWAT techniques during assignment with a Physical Security Support Element in Berlin Germany).

Existing computer-based training (CBT) systems for night vision devices (NVDs)/night operations. To date, we have identified five CBT programs addressing night training. They all focus on perceptual tasks. We have found none that address the cognitive and decision-making tasks associated with night urban operations.

VACR (Visual Aircraft Recognition Training Program) –Army Air Defense Center and School fixed and rotary-wing identification program. Contains 98 aircraft, thermal and visible imagery and videos.

CVIS (Combat Visual Identification System) – A Naval Air Systems Command aviation recognition training program for Navy and Marine Corps. Contains imagery of 180 air, 90 ground, and 10 sea combat systems. Contains animation, line drawings and comparisons of like systems. Contains no thermal or IR imagery.

JVID (Joint Visual Identification System) - Air Force ACC Training Support program in use by the Air Force for identification of 60 fixed and rotary wing aircraft. Although called "Joint" there is no joint aspect to this program at this time.

Night Driving Training Aid – train drivers of Army tracked and wheeled vehicles in the use and care of Image Intensified (I2) viewing devices. (STRICOM Phase II SBIR currently being developed by DCS Corp).

ROC-V (Recognition of Combat Vehicles) - Night Vision and Electronic Sensors Directorate (NVESD) and ARI. Focus is on vehicle identification and search/detection. We viewed portions of the ROC-V program. The ROC-V program includes basic thermal principles, target detection, and target identification. It presents thermal images in a variety of exercises with the goal of improving target detection and identification. The search/detection aspects are relevant to this SBIR project.

Front-end Analysis -- Results

As anticipated, there are no established training materials or CBT programs for the vast majority of tasks within the night urban operations domain. This was one of the precipitating reasons for this topic being submitted for a SBIR project – there is a real need for training materials to support night operations in urban terrain. Part of the problem exists because the Army does not have a proponent for training in this domain. Consequently, each unit devises their own ad hoc approach.

This project will need to include a knowledge/task analysis in addition to the development of the software. We will need to include further definition of the learning objectives and the development of training 'content' (information, multimedia, tests) for the selected set of tasks to be included in the Phase II development. We have a commitment from 3rd Special Forces Group to provide subject matter expert (SME) input, but it remains to be seen how much of their time will be available for developing training objectives and content. We will continue to try to get additional SME input and support for the Phase II development from other sources as well, such as the Rangers, Dismounted Battlespace Battle Lab (DBBL) and other cross-service units involved in night urban operations.

We developed a candidate task list for the domain. We scrubbed this task list with ARI and with SMEs at our Ft. Bragg interviews and refined the task list (see Table 1).

Table 1. *Phase I Domain Task List*

Task	SubTask
Command and Control	Control and Direct Group Maneuver with IR Laser Pointer NVG and IR Device Deployment Strategy Recognizing Hand and Arm Signals Task Organization
Light Discipline	Identification of Light Source and Type
Navigation	Map Reading Distance to Objects (Depth Perception)
Unaided night Vision	Scanning Techniques Peripheral Vision
Situational Awareness	The Effect of the Urban Environment on NVD's
Detection, Recognition, and Identification of Targets with NVG and IR Devices	Weapon Discharge Identification Weapon Silhouette Identification
Detection, Recognition, and Identification of Obstacles with NVG and IR Devices	
Detection, Recognition, and Identification of NVD signatures	
Clearing Rooms and Buildings	Fundamentals of Clearing Operations CQB Techniques
Acquisition of Targets with IR Devices	
Anti-fratricide and Identification Marking Devices	Recognition of IR Anti-fratricide and Identification Markers Designing Custom IR Anti-fratricide and Identification Markers

Note. IR = Infra-red; NVG = Night vision goggles; NVD = Night vision devices : CQB = Close quarters battle.

To keep within scope of a Phase II development, we needed to select a subset of the task list for implementation. It was recommended that we focus primarily on command and control tasks and include some aspects in the scenarios that address situational awareness, light discipline, movement into and within the urban site (outside and inside buildings, clearing

rooms). The training must also include thermal, as well as other image intensification devices. Training on proper wearing of night vision goggles and devices, map reading, and effective firing of weapons with IR weapon-aiming devices was determined to be outside the project's scope.

The initial task list was refined with focus primarily on command and control tasks. Additional tasks as they relate to command and control will be incorporated (e.g., light and noise discipline) [see Table 2]. We expect that this task list will be revised and refined with further investigation and SME input, especially during the Phase I Option period. Command and control tasks are critical elements of night urban operations incorporating both perceptual and cognitive elements. These tasks also present a tough training challenge, not only for traditional training approaches but especially so in a computer-based application. One of the key approaches for the training system will be problem-solving activities incorporated into interactive and task-relevant scenarios.

Table 2. *Phase II Candidate Task List*

Task	Subtask
Command and Control "Movement to Contact"	
	Task Organization
	Situational Awareness
	Light & Noise Discipline
	Movement (e.g., outside, inside buildings)
	Clearing buildings
	Anti-fratricide

Design of the Adaptive Training System

An initial design of the adaptive training system was developed and briefed, along with a sample graphical user interface (GUI) of this initial design. The initial design was approved, but the decision was made to omit authoring functions from the design. The authoring function would have allowed instructors to add new learning objectives and media. As the higher priority was the design and implementation of the training itself, this feature was removed. We have omitted discussion of this authoring feature from the Phase I results section and, of course, not included it in our proposed Phase II design. The proposed design for the NightOUT is presented in the section on Phase II Design.

Phase II Technical Objectives and Approach

NightOUT will provide interactive scenarios that address aided (thermal, image intensification) and unaided night vision issues that impact command and control in urban environments. The training system will adapt the scenarios, guidance and feedback to the individual's skills and needs. The overall goal of NightOUT is to provide soldiers with the fundamental knowledge necessary to perform their portion of a mission within the defined domain, to increase survivability in a night urban environment through awareness training, and ultimately to generate fully qualified domain experts.

NightOUT will address night operations within urban settings, with a focus on command and control tasks. It includes image intensification, thermal, and unaided vision. It will have the following training capabilities:

- Training sessions for the selected topics (e.g., presentations, exercises, scenarios).
- Training sessions based on soldier profile, pre-tests, and actions during training.
- Meaningful guidance and feedback.
- Database of media (graphics, video) to support training sessions.
- Administration features (registration, soldier data, instructor reports, researcher data).

Phase II Design

This section contains a more detailed description of the functions and technical approach for the design and implementation of NightOUT. We present an overall flow chart (see Figure 1) and describe the instructional approach, general features, and system architecture. In Appendix A, we provide a sample piece of a scenario-based training session for further illustration of the planned concept.

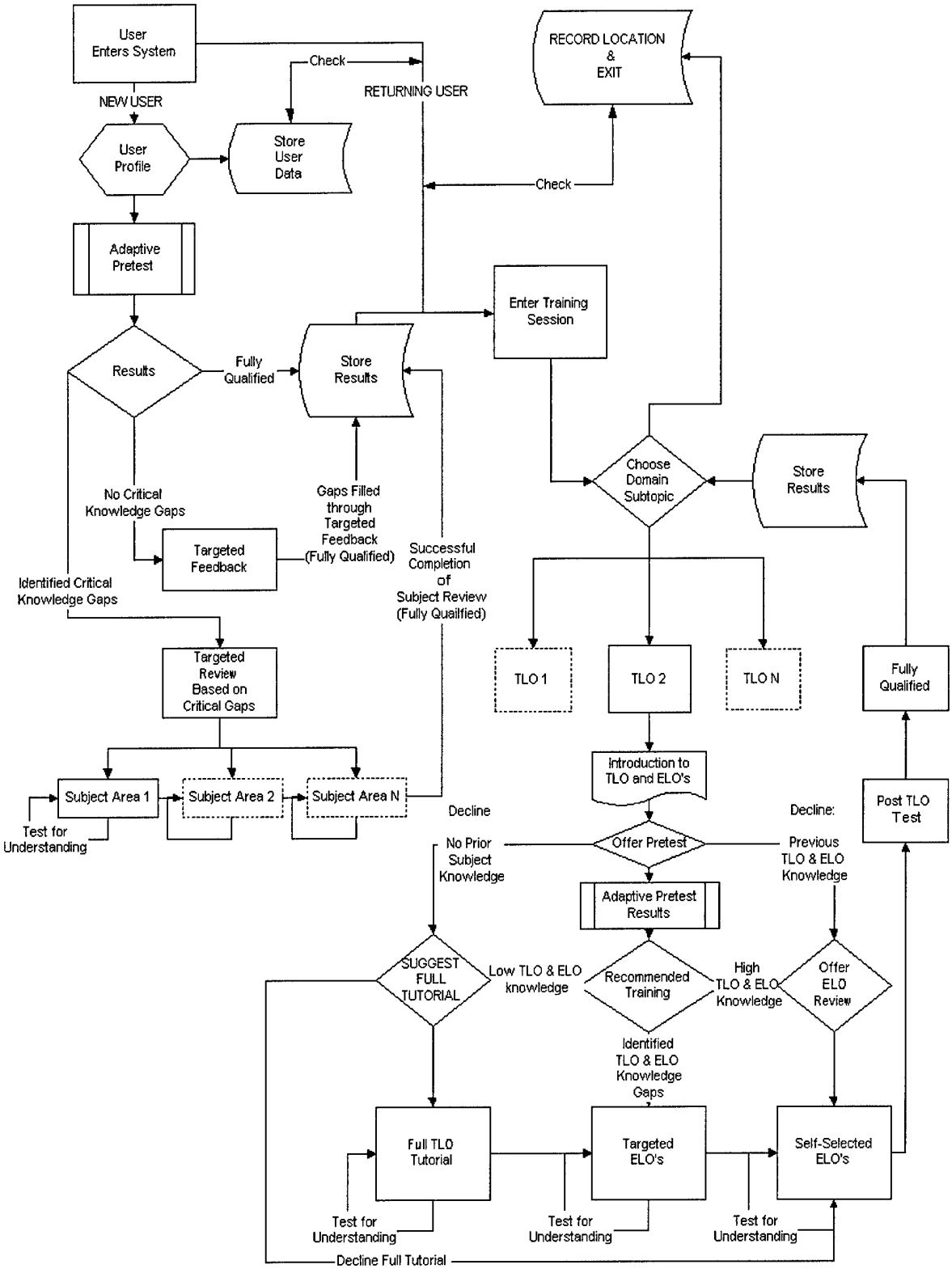

Figure 1. Night Urban Operations Trainer functional flowchart.

Instructional Approach

There will be two modes for training. In self-directed study mode, the soldier selects topics of interest and preferred learning activities. In tutor-directed training mode, the tutor selects the topic and learning activities based on an evaluation of what the soldier knows and does not know. This evaluation is based on an initial pre-test and topic specific pre-tests.

In both self-directed and tutor-directed modes, the training system provides feedback and explanations. However in tutor mode, the system will be able to automatically tailor the guidance and feedback based on the soldier's profile and skill level. At the conclusion of the training session(s), there is a comprehensive test to evaluate whether the learning objectives have been satisfied.

Fundamentals Training

Fundamentals training will focus on aided and unaided night vision training, characteristics and deployment of night vision devices, differences, compatibilities, and employment of dissimilar night vision technologies and care and maintenance of night vision. Current findings indicate that some of these training materials are available, but not consolidated into a comprehensive training package and might not be readily available to all soldiers.

After consolidating and assessing currently available material, we propose to transition existing material into the CBT and, if necessary, develop material to fill critical gaps. The fundamentals instruction will focus on the subset of knowledge necessary to support the topics addressed in the Phase II training sessions and scenarios.

Tutor-directed Training

Adaptive pre-test. Soldiers will first take an adaptive pre-test. The purpose of the pre-test is to determine whether the soldier has sufficient mastery of the critical fundamentals (basic principles and knowledge) required for the training sessions. If certain fundamentals are not demonstrated in the pre-test, then the tutor will present instruction on those items. The instruction may include presentation, demonstration, and various knowledge-based learning activities. Review and testing will occur until mastery of the fundamentals is achieved.

The content for the pre-test will be determined during the Phase I Option. Primary criteria are those fundamentals that directly support the proposed training sessions. Our goal is to leverage existing materials as much as possible for the fundamentals instruction, and focus more of our effort on the interactive training sessions and scenarios. Our initial investigations indicate that the fundamentals of unaided night vision training and I^2 training seem to be widely available, however there is an apparent lack of fundamental thermal device training.

The pre-tests will be adaptive. The questions that are selected and posed to the soldier will be based on the individual's performance on prior questions. If soldiers do well on a particular topic, then they are moved quickly to new topics. If the soldier does not correctly answer a question on a particular topic, then additional questions will be presented on that same topic. Additional questions help to more specifically evaluate what the soldier knows and does

not know. Also, a soldier may have misunderstood a question, and additional questions provide an opportunity to demonstrate that knowledge. The advantage of the adaptive approach for testing is that soldiers are evaluated more quickly and more thoroughly than with a standard test format.

Computer adaptive testing (CAT) algorithms are usually an iterative process with the following steps:

1. All the items that have not yet been administered are evaluated to determine which will be the best one to administer next given the currently estimated ability level.
2. The "best" next item is administered and the examinee responds.
3. A new ability estimate is computed based on the responses to all of the administered items.
4. Steps 1 through 3 are repeated until a stopping criterion is met.

Several different methods can be used to compute the statistics needed in each of these three steps. Our plans are to use a method based on Item Response Theory (IRT) (Rudner, 1998). Using item response theory, we can quantify the amount of information provided by an item at a given ability level and the tailoring process will quickly result in the administration of reasonably targeted items.

Of course, the algorithm behind the adaptive pre-test is only as effective as the questions in the test bank. The pre-test items and adaptive algorithm will need to be evaluated for validity and reliability.

Training sessions. After completing the pre-test (and fundamentals instruction, if needed), the soldier participates in the training sessions. A topic pre-test is given to the soldier prior to beginning a training session. The purpose of the topic pre-test is to determine what the soldier knows and does not know about the specific topic. This 'student model' is used to guide the tutor's selection of sub-topics and learning activities [see Figure 2]

The contents and activities will depend on the particular topic. There will be presentations, demonstrations, knowledge drills, role-playing and simulations. With the Phase II focus on command and control, most of the activities will be based around scenarios. Each scenario will include an introduction to the situation along with relevant graphics and reports (e.g., S2 report). The soldier will indicate factors/features and make decisions at specific points in the scenario. The scenarios will be 'storyboards' that branch, based on the soldier's actions. For illustration, Appendix A presents a sample scenario in more detail.

Some aspects of the scenarios will be custom tailored to individuals based on their profile. For example, a platoon leader would be tasked to organize his platoon for deployment and a squad leader his squad. All scenarios will be based on warning orders and fragmentary orders (FRAGOs) issued as the scenario develops. The default functionality of the scenario generator will be to match a soldier by rank and duty position. The system, however, will allow movement horizontally in both directions. Proper skills development is a ladder that builds on fundamental knowledge and specific domain knowledge through increasingly difficult scenarios

that challenge the soldier. Guidance and feedback will also be tailored based on the soldier's skill level. More guidance will be provided to less experienced soldiers, less guidance for the more experienced.

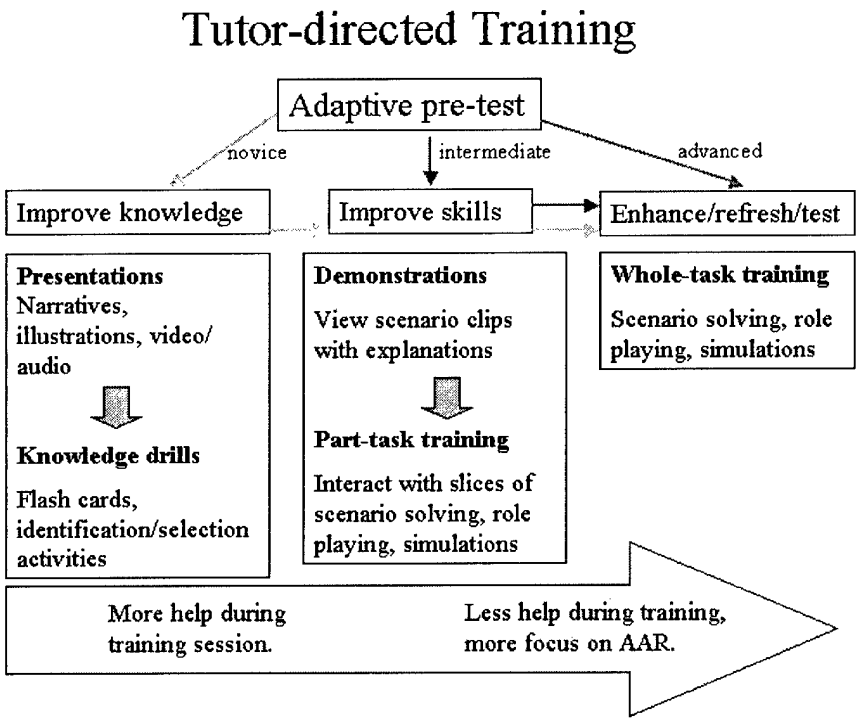

Figure 2. Tutor-directed training adapts to level of soldier.

Self-directed Study

We have also included an option in the training system that can accommodate users who want to direct their own study. They register, and then can view a list of the domain topics in the form of terminal learning objectives (TLOs). They can click on any TLO to start the training session. First they receive an introduction to the topic and are then offered three alternatives:

1. Take the full training session for the selected TLO (includes all tutorials and scenarios)
2. Take a pre-test and proceed through a recommended training session
3. Select specific tutorials and scenarios from a list for that TLO.

The training system will suggest that soldiers with no/little knowledge and experience with the specific TLO, take the full training session. Those with some knowledge and experience might better benefit from taking the pre-test or selecting their own items to study. However, these are only suggestions and in self-directed study mode, soldiers can choose their own path. After completing any of these three options, the soldier participates in a post-test.

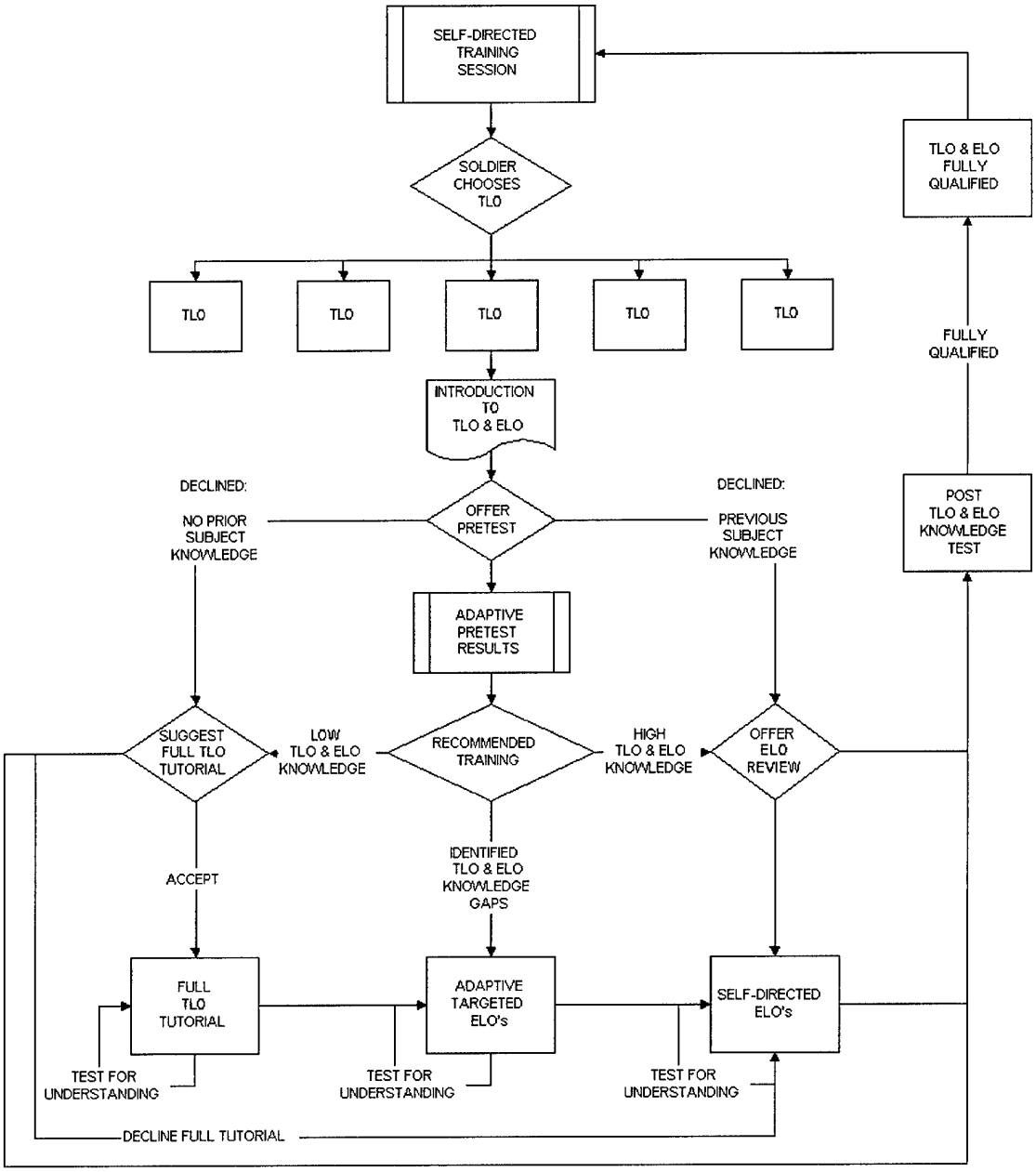

Figure 3. TLO Learning Model

Night Imagery

The goal of this training system is to achieve positive skill transfer to night urban operations in a real (physical) urban environment. After the storyboards for the training scenarios and fundamentals tutorials have been planned, we will know what key images will be needed to support the training sessions. The objects may be humans, weapons, vehicles, and features of the urban terrain, such as buildings, streets, and tunnels. We may need multiple

images of the same object(s) with various combinations of factors, again depending on focus of the training principles. The same object or scene might be viewed:

- Unaided and through different night devices NVGs, night sights, thermal devices (both black-hot and white-hot images)
- From different aspect angles and at different ranges
- With various ambient light dusk, dark, moonlight, artificial lights such as streetlights, building lights
- Within various urban contexts on the street, within buildings, on top of buildings

The quality of the night imagery used in the training system is of critical importance. We will need to include high fidelity digital photos and video of actual night imagery (unaided and taken through night devices). Where possible, we would like to leverage existing imagery but we expect that we will have to create new images. Creating high fidelity digital photographic images through night vision devices requires specialized technical expertise. Once the specific training sessions are outlined, we can determine the night photography and equipment requirements.

During Phase I we also did some initial experiments in creating computer-generated imagery. Using Adobe Photoshop, we applied custom-made filters and modified certain features (e.g., heat signatures) applied to daylight digital photos. With this approach, we can inexpensively create multiple through sight (Gen 1, Gen 2, Gen 3 and thermal) and unaided images of the same object/scene. This approach would work best for certain types of images, but not as well for more complex scenes. The results of the computer-generated imagery were very encouraging, and had definite possibilities for some of the training applications.

General Features

Log-in/registration. To begin using NightOUT, soldiers must first login. Login consists of a soldier's name, last four of the social security number (SSN), and password. The system will differentiate between soldiers who have previously registered and new users. New users will be prompted to register. Registration consists of: Last Name, First Name, Last Four, Rank, MOS, Branch, Duty Position, Unit, and First Line Supervisor.

Training tracking and session persistence. The training system will allow soldiers to stop the training session at any point and then resume the training where they last left the system. Tracking will be accomplished by storing an individual's progress and history in a persistent database.

Instructor reports and research data. Instructors will want to extract data about soldiers' sessions and test data. We anticipate that various instructors may want to view different data and formatted in different ways. In addition, we expect that researchers will use NightOUT to evaluate the effectiveness of different training approaches.

We will seek input from instructors and researchers about the kinds of data and format types that will be useful. We will design the database and GUIs so that the needs of these two

different groups can be met with ease and flexibility. Our current design retains user end points, accomplishments, placement, test results, and training records. Fields in NightOUT database will be easily exported in standard ACSII delimited format for straightforward insertion into spreadsheets or other databases.

System Architecture

Architectural design. The diagram in Figure 4 illustrates the various functions resident in NightOUT and shows the flexibility of the system design. For example, it can run in a stand-alone or distributed environment).

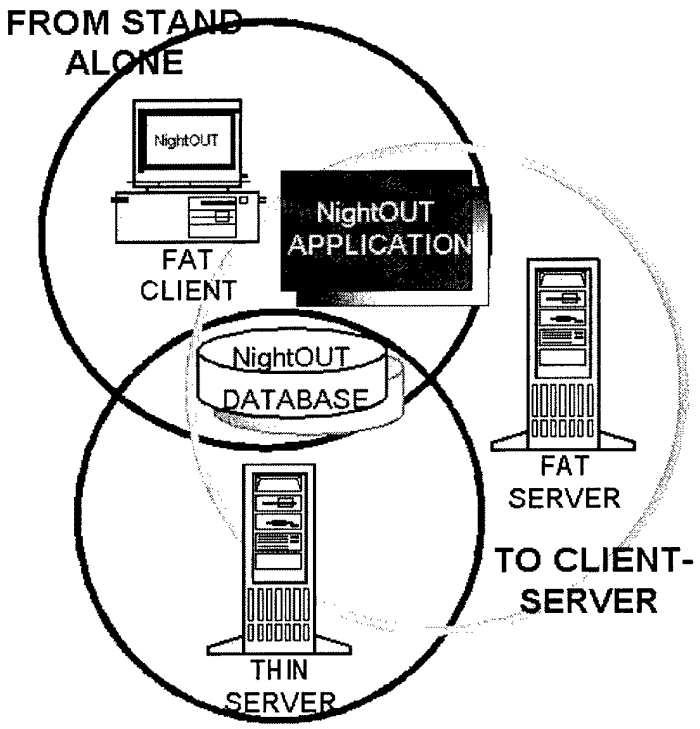

Figure 4. System Architecture

Platforms, stand-alone or distributed. NightOUT will run on any Windows98, NT 4.0, Windows 2000, or ME. Minimum system requirements are:

- VGA or higher resolution monitor (recommended 17")
- Pentium 150MHz processor (recommended 500MHz)
- 64MB of RAM (recommended 128MB)
- 2GB free hard-disk space
- CD-ROM drive
- Sound card
- Speakers or headphones

- Microsoft Mouse or compatible pointing device
- VGA Adapter supporting 1024X768 24 bit color
- Network Card (if established in a client-server environment)

We will design NightOUT so that it can run on a stand-alone PC or could be set up in a networked environment. For example, the database of graphics and video can be run from a server to various client machines in a LAN/WAN. The database could then be managed from a single point, which would simplify administration and updates.

Database. The database contains information about the soldier, units, and tasks (see Figure 5).

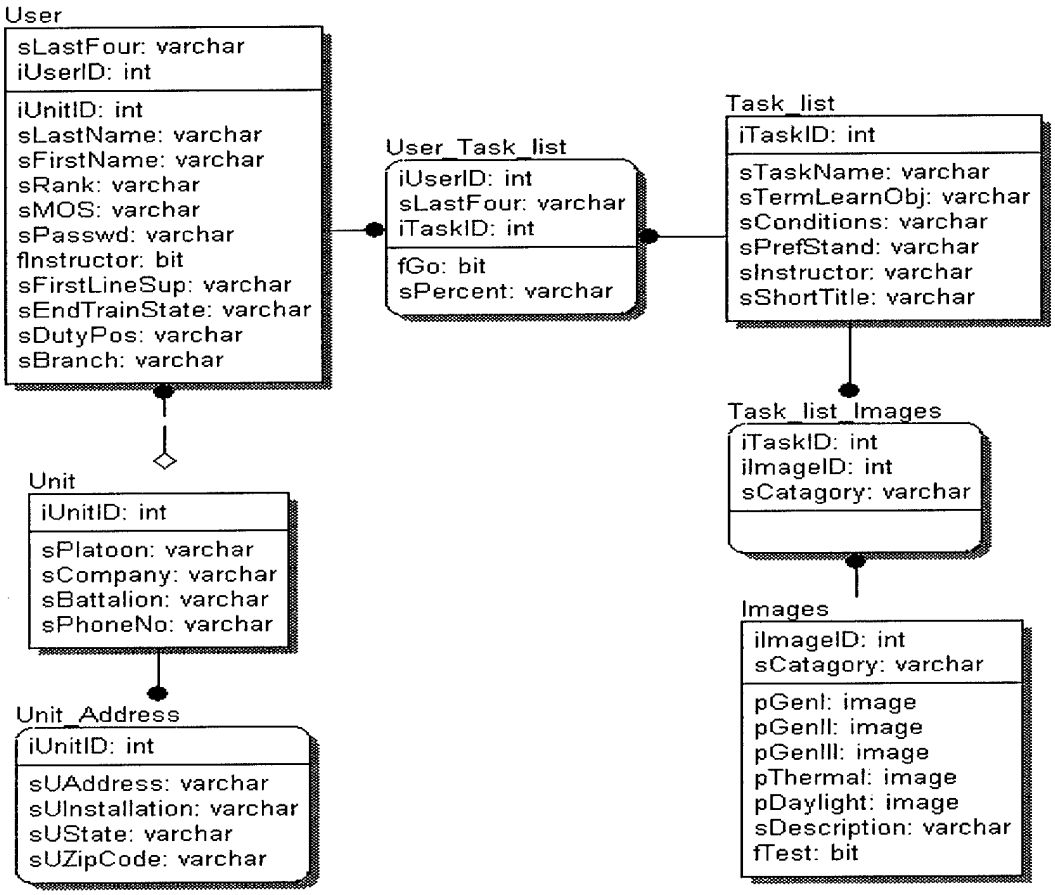

Figure 5. Database ER model

The database was designed using ERWIN, the only Integration Definition for Function Modeling (IDEF1X) compliant modeling tool available for database entity relationship (ER) modeling. This has several advantages. The database is designed to a measurable standard, as defined by National Institute of Standards and Technology (NIST). The ER model can be quickly modified to meet changes in design or requirements. ERWIN can generate simple query

language (SQL) for any standard data base management system (DBMS) (Oracle, Access, MSSQL, FoxPro, etc.). The interface between the application and the database, by design, is ODBC. This adds more flexibility. This standardizes the code required to access the database. It removes the requirement to purchase one vendors database over another vendors database. It allows the database to be physically located on a remote server, if so desired.

Relationship to Future Research and Development (R&D)

Successful development of the Night Urban Operations Trainer (NightOUT) offers multiple threads for future R&D that would be of interest to the Army, especially the Objective Force Warrior program. The domain and applications of the training technology would also be of interest to many Department of Defense (DoD) components.

Future R&D efforts of interest to the DoD might include:

- Expanded task domain coverage (additional night operations tasks, missions, and scenarios)
- Application of the adaptive training system to other domains
- Easy methods for non-programmers to create new task domains and scenarios within the adaptive training system
- Research evaluating and deriving optimal instructional strategies for various night operations in urban settings and other task domains

Future Phase III R&D commercialization efforts might include:

- Adaptive training system for night operations in urban terrain for other customers (e.g., police, intelligence agencies, Immigration and Naturalization Service, Alcohol Tobacco and Fire Arms)
- Intelligent computer-based training programs for a variety of task domains

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APPENDIX A

Sample Scenario

This example is provided to convey the basic concept for a scenario-based problem solving training session. The full sessions will include a variety of activities and multimedia depicting urban environments at night (aided and unaided), as well as feedback tailored to the individual.

Each scenario will be developed from the top down. As with all military operations, it is necessary to understand and comply with the Commander's intent. As operations orders are developed to support each scenario, each warning order and subsequent mission will in actuality be derived from an original high-level operations order. Soldiers at all levels would expect to see, and want to know, the mission of its next higher and adjacent units.

When developing each scenario, we will start by developing the Division operations order (OPORD), and then develop OPORDs for each lower echelon. During the actual scenario-based training sessions, soldiers will primarily work from Warning Orders and FRAGOs appropriate to their level, but they will also be able to view the next higher and adjacent unit OPORDs if desired.

The overall goal of NightOUT is to provide soldiers with the fundamental knowledge necessary to perform their portion of a mission within the defined domain, to increase survivability in a night urban environment through awareness training, and ultimately to generate fully qualified domain experts. In keeping with this essential ideology, the system will allow soldiers to expand their individual skills after they are fully qualified at a level associated with their rank and duty position.

Once soldiers are fully qualified at their level, they are invited to expand their knowledge through a series of increasingly challenging scenarios. Also the system could allow any soldier to view/participate in scenarios modified for their subordinates and superiors. Participating in subordinate roles may improve mentoring capabilities and participating in superior rule may aid in understanding commanders' intent.

Samples from scenario-based training session for: Platoon leader for dismounted infantry or cavalry platoon

GENERAL INSTRUCTIONS:

This final scenario will contain several sections. You should allow two hours of undisturbed time to complete a scenario. You will receive an Operations Order defining the overall goals and Commander's intent, a warning order that defines your particular portion of the mission and fragmentary orders as the scenario develops. It is recommended but not necessary to complete the entire scenario in one setting; the system will track your progress and retain your current position should it become necessary to prematurely end this session.

LEARNING OBJECTIVES:

TERMINAL LEARNING OBJECTIVE (TLO): Conduct small unit tactics in a night urban environment and understand the principles of Command and Control (C2) as they apply to night operations.

ENABLING LEARNING OBJECTS (ELOs):

1. Understand the principles of small unit task organization.
2. Understand the principles of light and noise discipline.
3. Understand the principles of C2 as they apply to night movement.
4. Understand the principles and techniques of marking friendly units and indigenous personnel to avoid fratricide.
5. Understand the principles and techniques for night close quarters battle (CQB) and building clearing.

EXERCISE: Platoon Level Command & Control Final Scenario

This scenario is broken down into five discrete exercises incorporating the C2 ELOs. It is designed to improve critical thinking, planning, execution, and command and control of small unit tactics in night urban operations. There are no right or wrong solutions, but your solution will be compared to "best practice", standing operating procedures (SOPs), and "expert knowledge" presented in the previous lessons.

Carefully read the Company operations order and your warning order. They are key to understanding the commander's intent.

NOTE: This will be a dismounted exercise.

INTRODUCTION:

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YOU ARE THE PLATOON LEADER OF 1st Plt., B Tr., 2 ACR (-), ATTACHED TO 52nd INFANTRY DIVISION FOR NTC ROTATION 01-12. THE FOLLOWING ARE EXCERPTS FROM AN OPERATIONS ORDER FOR THE 52ND ID TO CONDUCT AN ATTACK. THIS MISSION ENDS WITH PHASE 2. YOUR MISSION ORDERS FOLLOW, UNDERSTAND AND COMPLY WITH THE COMMANDER'S INTENT.

[Note: the soldier will be able to view his Battalion OPORD, his Company OPORD, and the mission of any adjacent unit's. We present in this sample, just the Warning Order.]

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YOUR MISSION ORDERS

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Warning Order

Signal intelligence units, recon satellites, and information from other intelligence sources indicate that the enemy has established a headquarters area in Grid Square ZZ1044. The enemy is using the road running east west through the area to move equipment and supplies. All road junctions and trails are under enemy control and the entire area under surveillance. Your mission is to get in there and recon the area without being caught for a period of not less than 48 hours.

1st Plt, 1st Recon Troop, 2 ACR(+) will capture their forward HQ in Musutiste. NLT 120600SEP01 during hours of darkness, you will infiltrate their HQ, kill as many officers or key personnel as you can, and get the hell out. You will let your relay station know when you are on your way out. They will launch your slicks to the LZ. Intelligence indicates that this is a Regimental HQ and the probability of at least field grade officers is very high.

There will be a full S2 briefing in 1 hour at Battalion. You will be able to meet afterwards with the Air Liaison. The area is 125-kilometers north and well beyond artillery support. The enemy has extensive signals intelligence capabilities and you can expect artillery or rocket fire within 2 minutes of any radio transmissions.

Enemy Forces

- Ref: Division OPORD

Indigenous Personnel (IP)

The IPs seem to be sympathetic to our action. But a direct assault into Musutiste might cause a change of attitude. As always, collateral damage must be kept to a minimum. If possible, avoid IP fratricide, but do not abort the mission. Spot reports and an S-2 debrief will be conducted after the mission. Ascertain what information you can about:

- Do they work? Where? Farmers?
- Are they friendly? How has the enemy treated them?
- Do we have a contact in a partisan group we can use if necessary? Can they be trusted?
- Do they keep dogs?

- Do they have electrical power? Vehicles?

  Friendly Forces
- 2nd Plt., 1st Recon Troop, 2 ACR will capture and destroy Communication Support Center in Musutiste
- 3rd Plt., 1st Recon Troop, 2 ACR will capture Re-supply Point Alpha east of Musutiste
- Frequencies to use on the days in question to contact them. Current SOI
- Inter-unit call signs and passwords. Unit SOP
- CEOI codes. To be issued.

  Weather
- Ref: Div OPORD

S-2 Brief: (full S-2 brief would be included)

See attached map:

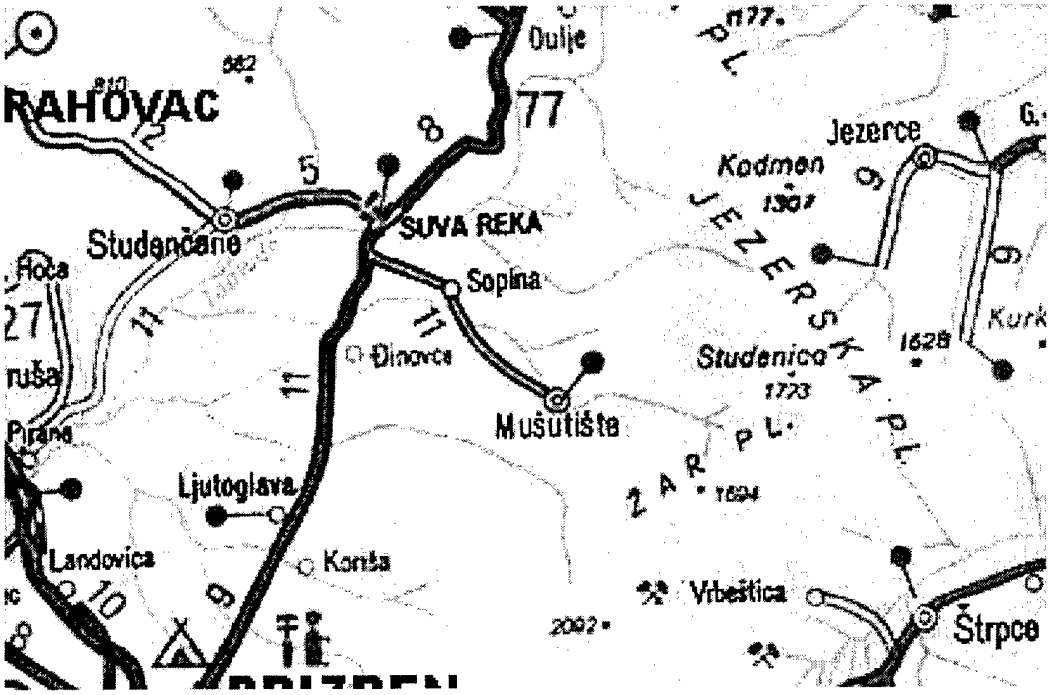


Figure A-1. Area of operation map

EXERCISE 1: Understand the principles of small unit task organization.

INSTRUCTIONS:

Because of the importance of this mission, the battalion has augmented your platoon with three sniper teams. One of the sniper teams has been outfitted with the new M91 with Thermal Scope. Your platoon has its full complement of 27 members including yourself.

In this exercise you will be required to:

- Task organize your platoon and distribute your limited night vision equipment.
- Assign C2 for squads and sniper teams
- Determine disposition of your sniper teams.
- Assign squad missions/objectives.

NOTE: You cannot remove or exchange equipment belonging to the sniper teams.

Part 1: Distribution of assets and squad mission assignments.

In the window below drag and drop equipment on squad members. Use the pull-down task list to assign missions to each squad. If you desire, you may drag and drop sniper teams to augment a squad. You can also assign direct C2 for each squad or team to key individuals by dragging and dropping the key member on the squad or team. When you are finished click "NEXT" to continue. If you are unfamiliar with or desire more information about an issued piece of equipment, simply right click on the equipment icon and select "*More Information*".

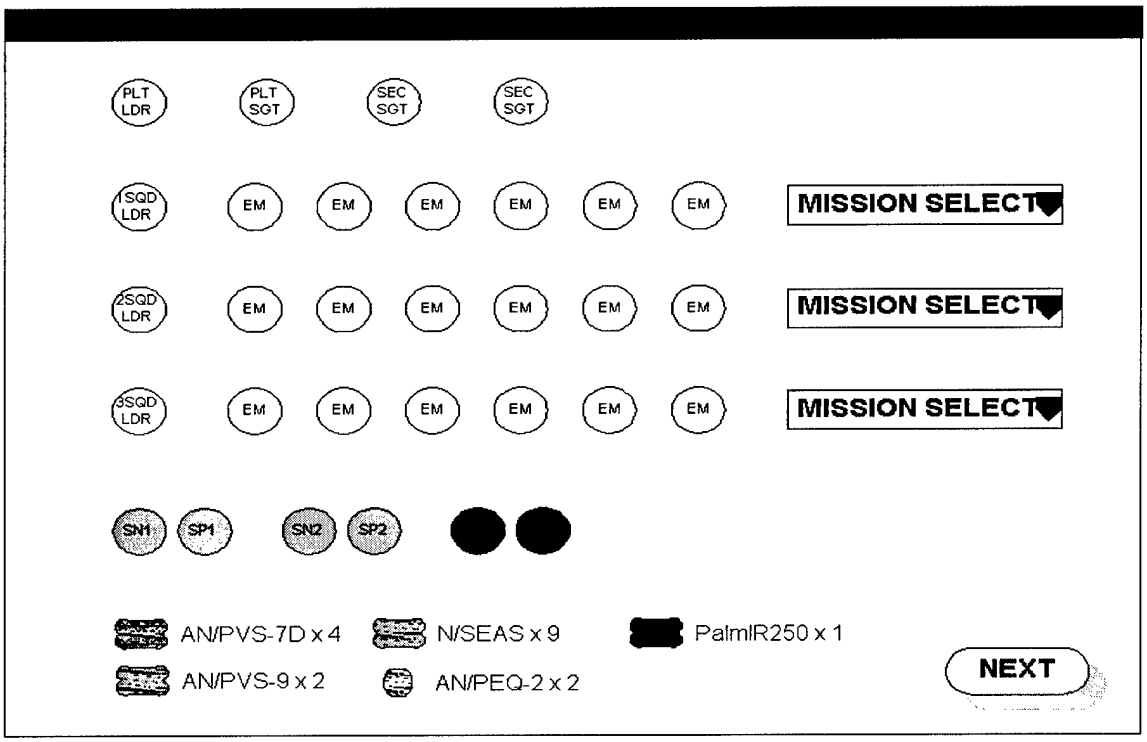


Figure A-2. Mission assignment interface

NIGHT TIP: Right Click on each NVD to view its capabilities and deployment strategies.

Scenario Scalability:
NOTE: As it applies to this scenario only.

Within the scope of the scenario, the soldier could potentially enter at any of the pre-defined positions, from sniper team member through platoon leader or even as a company commander, trying to determine how best to utilize his assets. Warning and fragmentary orders will be pre-defined but dynamically generated to include real unit information (this will add to the realism and creditability of the scenario and relevance to the soldier).

An ultimate incarnation of this process would be: The platoon leader runs the scenario first and makes his assignments. The system would then evaluate his performance on all aspects of the TLO and ELO's compared to 'Best Practice' and allow him to correct or adjust his plan accordingly. As members of his platoon attempt the scenario, their session would be influenced by the decision of the platoon leader. If the platoon leader has not finished the training, members of his platoon would conduct the computer pre-generated scenario.

Feedback Scalability:

Feedback is a critical portion of the training especially since we are presenting 'best practice' as opposed to right or wrong solutions. Depending on the level of the soldier we might use though provoking questions or statements at the highest level and facts at the lowest level.

As an example:
Here our platoon leader has assigned all three squads to clearing the building. The feedback might be: Who will provide cover fire for movement into and out of the building?

The platoon leaders response might be: I will assign my sniper teams that mission. To which the system might reply: Snipers cannot lay down a steady volume of fire, which might be required to break contact after the assault.

Or his first choice might have been to assign himself the PalmIR and an AN/PEQ-2, but he has decided to accompany the assault team into the building. The feedback might then be: The AN/PEQ-2 is better suited for directing fire at a distance and might not be as effective in a CQB environment.

For a platoon sergeant who has been assigned C2 over the squad covering the regress after the assault, he might have been issued a PalmIR, two AN/PVS-7s and an AN/PEQ-2. Of which he assigned the PalmIR and AN/PEQ-2 to himself.

The feedback to a more experienced soldier might be: "Best practice indicates that an AN/PVS-7 is a better compliment to the AN/PEQ-2."

Additional clarifying information will be automatically provided to less experienced soldiers, but also available to any level soldier by right clicking on the icon or image and selecting "*More Information*".

"A thermal device, such as the PalmIR, is not capable of perceiving the IR laser transmission of an AN/PEQ-2 and might hinder your ability to effectively direct squad fire."

Scenario Graphics:
Graphics will play a key role in enhancing the appearance of the scenario and provoking thought. As the scenario develops, the soldier will be presented with "This is what you see now" type images. These images will help shape the scenario and provide branch points for decision-making.

As an example:
During the movement to the AO, the platoon approaches the city and the platoon leader is presented this image:

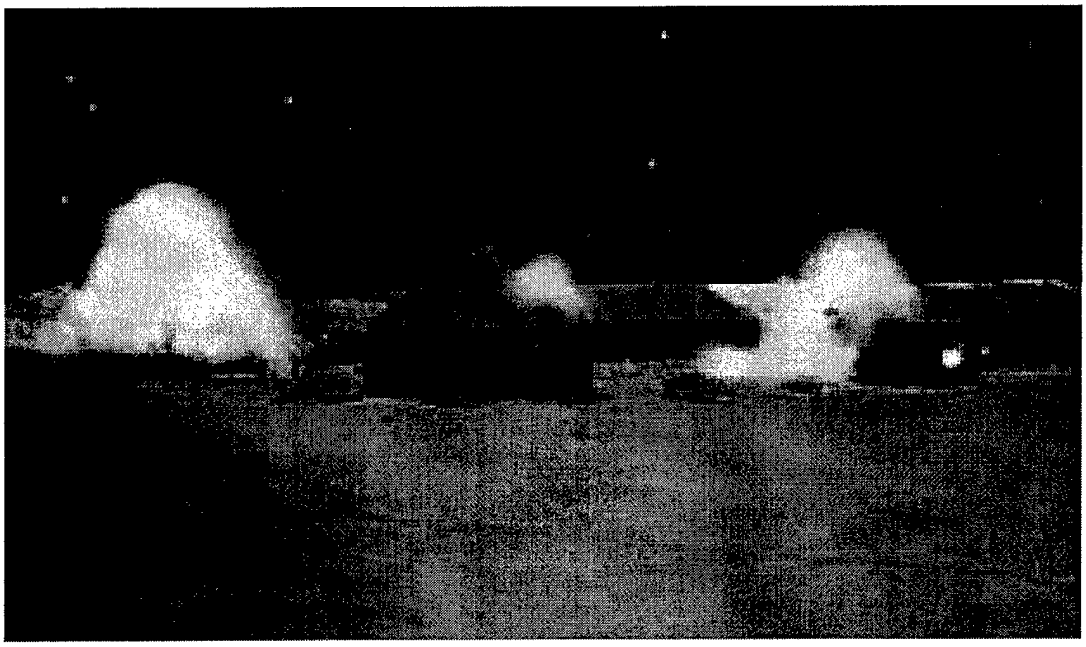


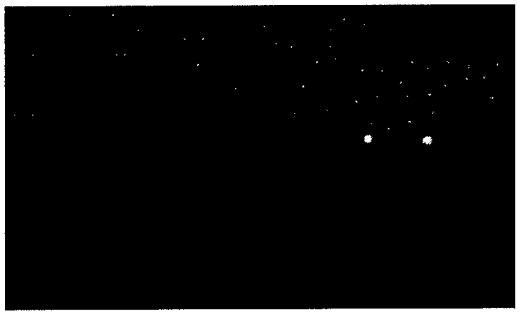
Figure A-3. Target view through artificial light

The system would ask him to make an assessment and decision. Ideally the platoon leader would issue a fragmentary order to one of his squads to cut power to the city.

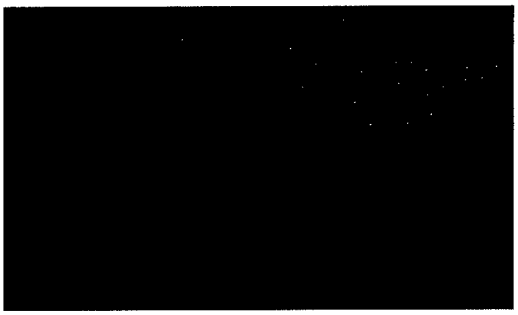
[Tips and explanations will be provided throughout the scenarios to help the soldier develop and refine general principles.]

NIGHT TIP: NVDs based on image intensifier technologies are greatly hindered by artificial light sources.

After making the 'best practice' decision, or being guided with feedback to that decision. The system might present the soldier with these images:



The city as seen through your NVG



The city as seen with the unaided eye.

Figure A-4. Night vision goggles and unaided eye view comparison.

Again the soldier is asked to make an assessment and a decision. Here there appears to be two IR sources that are not visible to the naked eye.

NIGHT TIP: There are artificial light sources that are visible to an NVD and not visible to the naked eye.

Note: Along with feedback, soldiers will be provided tips that tie directly back to device or concept being taught in that portion of the scenario. These tips will re-enforce the fundamentals and importance of night vision training.